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THE TRANSFER FROM MODALITY PERCEPTUAL TO MODALITY CONCEPTUAL.

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LANGUAGE LEARNING EMPHASIZING THE IMPORTANCE OF AUDITORY FACTORS IN READING WAS SURVEYED. THE AUDITORY-TO-VISUAL SYMBOL SYSTEM ASSOCIATION IS DEFINED AS THE ABILITY TO ASSOCIATE SOUND LABELS WITH VISUAL LABELS (AND VICE VERSA) ON A GESTALT WHOLE-WORD BASIS AND ON A PHONEME-GRAPHEME ANALYTIC-SYNTHETIC BASIS. THE DECODING (READING) AND ENCODING (SPELLING AND WRITING), OR THE TURNING OF THE GESTALT OF LETTERS INTO SOUNDS AND THE GESTALT OF SOUNDS INTO LETTERS, IS DISCUSSED. THE IRREGULAR ORTHOGRAPHY SYSTEM IN ENGLISH REQUIRES EACH PAIRED ASSOCIATION FOR EACH WORD TO BE LEARNED BY ROTE MEMORY IN ASSOCIATION WITH ITS MEANING-IN-CONTEXT. IN SEVERE DISABILITY CASES, THE NEED TO IDENTIFY AUDITORY PHONEMES, TO ARTICULATE CLEARLY, THEN TO SPELL AND WRITE WORDS AND SENTENCES AS AN AID IN LEARNING TO READ IS EMPHASIZED. REFERENCES AND TABLES ARE PROVIDED. THIS PAPER WAS PRESENTED AT THE INTERNATIONAL READING ASSOCIATION CONFERENCE (SEATTLE, MAY 4-6, 1967). (MC)

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THE TRANSFER FROM MODALITY PERCEPTUAL TO MODALITY CONCEPTUAL*

by

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This topic if thoroughly examined would fill several thick volumes, even with the present state of limited knowledge possessed by psychologists, neurologists, linguists and educators. Therefore the most I can hope to do in this paper is to indicate

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to teachers and clinicians that there is more to reading than, shall I say, meets the eye. Current work in the area of language in neurology, linguistics and psychology all seems to point to at least three (and probably many more)levels or areas of functioning.

THE SENSORY LEVEL

The first "level" is the sensory and it includes hearing, seeing, movement sensing, touch etc. as well as the primary areas of the cortex where the sensory signals are first received and - from the sensation aspect only - identified as having primary physical attributes, e.g., shapes, noises, colors, bulk. However there is no recognition and still less understanding on this level. Neurologically this sensory input is very likely decoded in this simple way in both the sense organs themselves and their respective primary cortical areas. These functions, which operate well even in babies, must obviously be intact if a child is going to learn to read in the usual way yet many learning disability cases with primary neuro-sensory deficits remain undiagnosed, and I do not refer merely to the hard-of-hearing or partially sighted. By the time a child comes to learn to read he has usually acquired a fully working auditory/

vocal language and so all he has to do is associate a visual code with this auditory/vocal code. However many learning disability cases do not have a competent auditory/vocal language and so before examining this audio-visual linkage I would like to discuss the way in which auditory/vocal codes become associated with meaning. To do this I would prefer to not use the ambiguous term "word" but substitute for it "sound-label" (and later on, "visual-label"). These terms are, respectively, shorthand for the spoken or heard word and for the read or printed word, the latter representing the succession of phonemes which comprise the former.

THE PERCEPTUAL LEVEL

Much of the experience most people have throughout their lives is non-verbal even when verbal activity is going on coincidentally. We drive the car, watch television, listen to music, play sport and so on. This direct experiential material is built up some of it selectively from birth coming in through the body and its senses into a main memory store which seems to cooperate with other cognitive processes to cross index, superimpose and freely associate the received "images" into concepts or meanings. Thus when we see a particular chair we classify it non-verbally as one of those single-seated pieces of furniture in which one adopts a specific relaxed posture. A non-verbal

infant could conceivably not be acquainted with the sound-label "chair" yet know its function. Thus perception combines 'indentified' sensory input data with meaning or concept, the latter being a function of utilitarian attention or other survival-value experience. Neurologically it is possible that this perceived meaningful material may in terms of memory be stored in what Penfield and Roberts (1959) call the "interpretive cortex". They say, "Psychical responses may be called experiential or interpretive. They have been obtained . . . only from certain portions of the temporal lobe cortex in either hemisphere". Much of this experiential or perceptual memory bank is non-verbal in the strict linguistic sense. The unit of perception then, as an internalised composite of meaningful images, is termed a concept. More correctly, a percept is one type of concept namely one which involves an immediate sensing of the environment.

THE CONCEPTUAL LEVEL

A concept can be defined as an enduring (and most likely progressing) coalescence of related images usually in the form of a class (e.g., government, table, furniture). Whereas a percept must always involve an immediate meaningful interpretation of the environment a concept may be manipulated internally without reference to the immediate non-verbal physical environment. If we ponder on a mental arithmetic problem

or next year's vacation we are thinking, that is manipulating concepts internally. Thought processes may take place with or without continuous or intermittant non-verbal percepts. A watchmaker repairing a watch resolves the problem (on the basis of previous experience-built concepts) under circumstances of acute visual perception. Conceptualizing (thinking) usually includes some form of reasoning, a process which involves the manipulation of the relationships between separate image-type concepts, (e.g., If I put the chair on the table I will be able to replace the broken electric light fitting).

SYMBOLS

A symbol can be defined as an "object" or "thing" which, being indelibly associated in the mind with another "object" or "thing" serves as a recall agent for the latter. A flag can symbolise national identity and spoken words can symbolise almost anything. The important point is that the symbolic-object is, in its own right, also a primary object which is sensed, perceived and conceptualised. When these symbolic objects are verbal labels (symbols) of various types we call the percepts, concepts and relationship reasonings which they represent a spoken language. Obviously the purpose of symbolic systems such as spoken language is to enable us to communicate with each other, or to reason without having to manipulate real objects directly. Instead of showing people how to put the

chair on the table to get to the broken light I can tell them using sound-label substitutes. Thus the spoken word may facilitate conceptualizing but is not itself conceptualizing. Still less is verbal activity equatable with abstraction, which is a higher order conceptualizing process frequently visuo-spatial in modality, as for example in abstract art.

In the written form of languages we have a system of secondary (visual) symbols which represent the primary (auditory-vocal) symbols which in their turn represent the perceived objects or coalesced concepts. These secondary (visual) symbols are also objects in their own right which are directly sensed, perceived and conceptualized just as are both the primary auditory symbols and the original objects. Therefore a written phonetic language expresses a sensory, perceptual and conceptual system, the latter two being capable of symbolic expression through two symbolic systems.

The way in which the psychological imagery processes are cross-related with the two symbol systems is presented in some detail in the following table.

TABLE I The classification of images and their symbol systems by type of psychological process during decoding operations, and by implication some encoding operations.

Psychological Process	Images of Objects Actions, etc. Non-Verbal (Internalized)	Association Process	Primary Auditory Symbol System (Auditory Verbal)	Association Process	Secondary Visual Symbol System (Visual to Sound Verbal)
Sense Data Awareness	Unidentified Image e.g. an object with a rectangular flat top, four legs, etc. (1)	No Association ←//→ (8)	The sensing of a series of sounds which have no concept associations although they may be perceived as unkown words e.g. listening to an unknown language (12)	No Association ←//→ (19)	The visual sensing of a series of line configurations in patterned sequences e.g. looking at a page of Chinese print as non-readers (23)
Developmental Process	Familiarization through repeated sensing, usage teaching, etc. (2)		Auditory-sound decoding into images through learned contingencies (13)		Visual decoding of the printed word through learned associations with sound-labels (words) (24)
Percepts	Recognition of an immediately present object, action, etc. (or its pictorial equivalent) as something repeatedly experienced in different situations. e.g. something one works on, eats from, puts objects on. (3)	Learned-by-memory image to sound-label (word) pairing. Image and symbol have been repeatedly associated in experience ←→ (9)	Hearing a particular sound-label (word) or a simple string of such labels, and being able externally or internally to identify any image associated with that label. e.g. "See that TABLE" ---> identification (14)	Learned-by-memory gestalt printed word sequence patterns associated with relevant gestalt sound-labels. Or for beginner readers or new words grapheme to phoneme matching trials ←------→ (20)	The child beginning to read will learn to recognise (a) some whole visual word patterns as symbolizing a gestalt of sound (a word) and (b) some sequences of visually coded phonemes which he must blend. The ratio of (a) to (b) will depend on look-say to phonics teaching methods ratio. e.g. T-A-BLE (25)

(Table continued on next page)

Developmental Process	Internal development through perception and memory of permanent integrated networks of image concepts all inter-associated. (4)		Internal development of grammatical coding systems linking sound labels - partly innate and partly mimicry (15)		The learning of visual grammatical sequences which more or less correspond with auditory sound label grammatical systems. (26)
Concepts	An internalised grouping of coalesced similar (or closely related) images within and across all sense modality experience. Concepts are usually generalized and form spatial and temporal hierarchical classes e.g. these objects as a class have a flat working surface, leg (s) being mostly empty space beneath. i.e. a meaning without a symbolic label or representational concepts. (5)	(a) Automatic selection of context appropriate image-label associates, that is sound labels pull out percept images or concept images (b) Inasmuch as encoding takes place as an aid to decoding we can say that the sound labels are more or less automatically grammatically sequenced. Both processes (a) and (b) are probabilistic and take place within a generalized concept i.e. they are, in Osgood's terms "homeostatic and qualifying" (Osgood 1963) (10) →	Here there is a corresponding hierarchial classification of sound-labels possibly into Osgood's "Word Form Pools" Auditory closure operates in this system facilitated by familiarity of both concept and label and by the semi-automatic retrieval of habitual sequences of sound-label strings (phrases or sentences) within a particular concept class of images. (e.g. the table is made of wood and has four legs) Thus some probabilistic prediction of sound-label and sequence is possible. (16)	Arbitrary printed word-sound label associations or arbitrary grapheme-phoneme associations of irregular orthography (in English). Also learned matched grammatical sequences of both sound and visual word labels i.e. automatic grammar correspondence associations ←------ (21)	Good readers must be able to recognise (i.e. perceive and conceptualise) the gestalt of sound in a printed word label, or else be able to "sound it out " if the word is unfamiliar. Visually coded labels (words and morphemes) in Visual Word Form Pools will correspond (be associated with) their equivalent sound-label Word Form Pool Contents. Visual closure is facilitated both by familiarity and by the semi-automatic habitual letter and word sequences within their associated concept-idea-class-area. (27)

(Table continued on next page)

Developmental Process ↓	Development of intellectural cognitive processes as studied and elaborated in the works of Jean Piaget. (6)		Development and understanding of sound-labels (words) for various relations possible between concepts. (17)		Development of visual label equivalent forms of relational sound labels. (28)
Thinking as a dynamic process of manipulating inter-related concepts	Non-verbal non-symbolic concepts and their inter-relationships (which incidentally are higher order concepts) can be processed in accordance with the "thought-computer-programs" available. In other words concepts can be sequentially reasoned with through time in accordance with the innate laws and acquired rules of thought. e.g. geometry Note that lines, angles, planes, etc. and their inter-relationships are not symbolic - they are true visuo-spatial abstractions. Symbolism and abstractions are far from synonymous. Also note that images, percepts, concepts and even their inter-relational 'modifiers' can be visuo-spatical, auditory, kin-esthetic-motor, tactile, taste, olifactory visceral, propprioceptive, temporal or any combination or permutation of these. (7)	Probalilistic selection of sequential concept (image) sound-label associat- (es. i.e. syntactical stringing or decoding of such. This process would be in Osgood's terminology "multiplicative and quantifying." The selection of sound-labels in encoding or the thought process in decoding is also partly determined by the thinking program in use, i.e. the relationship associations between concepts. <----> (11)	To the above (16) sound-label selection processes can be added further relational sound-labels plus those semi-habitual string sequences (sentence and phases.) which match the laws and rules of "rational" thought e.g. legal terminology abounds with these sound-label sequences of a relational and inter-relational type. On the other hand original or unfamiliar thought-speech or listening (or reading (29)) is less habitual, less fluent, more hesitant. (Goldman-Eisler, 1964) (18)	Same as above in (21) but the sound and visual label associations and their grammatical sequences are more complex in accordance with the relational concept system they symbolise. <----> (22)	The ability to decode conceptual meaning from the printed word using many complex associations on several levels (all described in other sections of this table). e.g. reading a report of a scientific research project. This requires the reader to decode first in sound-label grammatical strings as described in (18). I am of the opinion that all verbally facilitated thinking, conceptualising or perceiving on any level whether decoding or encoding always utilizes auditory symbols. Even so, much thought is non-verbal e.g. in art, science and music. (7) But when we read we first decode to the auditory stage and then use sound-label language as the medium for thought. (29)

SYMBOL SYSTEMS

If the above table is examined carefully it is largely self-explanatory. As one moves down the imagery or symbol system columns their content, the vertical developmental processes and the horizontal association processes become increasingly complex - which is not surprising since the transition from the top left hand sense-data corner to the lower right-hand reading/reasoning corner parallels the likely psychological evolution of the human organism.

The developmental progression although it may sometimes appear to operate on a continuum from sensing to thought probably does not do so. It is highly likely (and at the sensory level fairly certain) that specific areas of the brain may take care of each psychological function, namely sensing, memorising (as an aspect of perceiving and simple conceptualising) and thinking (Penfield and Roberts, 1959 and Mountcastle, 1962). It is also probable that the two symbol systems being of sensory origin also each have their specific neurological territory. And it is not a contradiction of the foregoing statements to say that all these neurological facets of the brain overlap and interlock in unbelievably intricate inter-communication systems. Psychologically these are the association, control and feed-back processes through which the functioning of the parts is integrated. Of course the higher functions, together

with the complex symbolic labelling and sequencing they involve, usually incorporate all the lower levels in their operation. Even so one can obviously think in the absence of immediate sensory stimuli.

The childhood development of conceptual imagery and thinking has been investigated by many people notably Piaget. The work of the "symbolic" logicians is also relevant to the laws and rules of human thought. However although Osgood, Wepman, Kirk and others have constructed excellent models for the hierarchical classification of language and conceptualizing processes, until recently no clear theoretical distinctions had been made between imagery/concepts and the two symbol systems. Osgood (1963) has analysed the relationship between meaning and sentences, particularly from the syntactical psycholinguistic point of view. This approach with its "meaningless word form pools", "semantic key sorts" "cognitive mixers," etc., seems to me most fruitful if only because meaning or conceptualizing is theoretically distinguished from (and related to) words, syntax, etc. But though Osgood explores cognition, semantics and linguistics he is not concerned with distinguishing between auditory and visual symbol systems - (except to say very briefly once or twice we do not speak the way we write, a factor which I consider may be an artefact of repeated polishing).

The essence of Osgood's thesis as I intepret it is that during the encoding of an assertion, non-word menaings selec-

tively determine, on a probabilistic basis, the "choice" of words and their positional sequence. However it is difficult to determine if Osgood considers abstract conceptual thought possible in the absence of internalized signs or symbols. Inhelder and Piaget (1958) seem to be of the opinion that logical thought processes are not founded in verbal symbols or linguistic material.

Before going on to the part played by association I would like to emphasise that in the interests of clarity and brevity I have here vastly over-simplified both my own conceptualizing of the whole topic and the neuropsychology involved. Like many other people I consider that the sensory-neurological "workings" of the brain most likely operate on a basis of a stochastic selection of bits of stored information of any and all kinds and of matching, integrating, decoding and encoding them meaningfully. Visual and auditory imagery may even be stored in operationally different memory systems (Bannatyne, 1966) the former perhaps being a "spot" or bit matching process whereas the latter may be a more gestalt-unit sort of registration. This would explain some of the real problems a few dyslexic children have matching a well learned auditory/vocal language to or from its visual/written version. It also fits in with Osgood's contention that the word is the base unit of language and by implication the concept the base unit of thought.

THINKING, REASONING AND LANGUAGE

Although language is not thinking it is a symbolic medium for facilitating, expressing or communicating thought, and it does so with varying degrees of accuracy. Sometimes, for example, when speaking at speed I choose a word to express a concept even though I know it is not an exact match. Nevertheless since language, or more precisely words, phrases and sentences, roughly mirror thought processes it is possible (as the symbolic logicians have done) to use them to study the nature of thinking. As thinking (i.e. conceptualizing and reasoning) cannot occur in a vacuum - we have to think about something - the total process involves one or more of the following: (a) actual sensory 'external'objects (the watch repairer situation); (b) the internal images of those objects (the artist who paints from memory or composer whose memory imagery is auditory; or the choreographer whose memory imagery is partially kinaesthetic); (c) primary auditory symbols (speaking and listening); or (d) secondary visual symbols (reading and writing). All these, usually in various continuously shifting permutations and combinations, participate in thinking and reasoning, but only (a) and (b) can be the subject matter which is the content of the thinking. The thinking and reasoning aspect is a process of internally manipulating this content and the term manipulating, is used because when actual objects, as in (a), are represented as an immediate

concept/content they <u>are</u> often manipulated by the hands usually using tools (hammers, trucks, radar, etc.) at the bidding of thought/reason. Apart from the image/concept content what extra then does thought/reason have which internally manipulates these? The answer is, <u>relationships in space - time</u> involving <u>active change</u> wrought by some physical or biological agent or agents in the widest sense of those words. Note, that the 'active-change' may be zero because 'staticity' is one extreme end of the change continuum. These changing space-time relationships of external objects (or the internal equivalents of the latter namely images, percepts, concepts), when processed by the human brain <u>are</u> thinking and reasoning. Even the assertion, 'I am happy' denotes a certain endocrinological ego-environment homeostasis, an interactional continuing space-time relationship.

These internalized relational elements between image type concepts are actively utilized in the neural thought processes so that the human organism can postulate trial manipulative 'runs' of the image/concept-data without having to deal with or handle the objects themselves. It is not too much to suggest that thinking and reasoning evolved because there was (and is) an immense survival value in the organism being able neurologically to <u>simulate</u> (symbolically and sometimes abstractly) actual or possible or even hypothetical series of interrelated events without the acutal events occuring, or without the objects themselves being present. A definition

of thought in those terms would be the dynamic (neurological) manipulation of internalized models and their interrelationship structures, all of which attempt more or less to simulate reality (e.g. planning a road system or even an abstract painting).

These thinking and reasoning relationship manipulations are the <u>key</u> to the nature and structure of all meaningful language as symbol systems. In fact, I am of the opinion that morphemes, words, phrases, sentences, and from another angle, syntax are no more or less than auditory or visual <u>labels</u> strung together as the communicative <u>matching equi</u>valents for pure sensory-originated (in the past) image concepts and their direct interrelationships. The communicative aspect may be internally facilitatvie or externally transmitting or both.

Summarizing the above discussion, we can say that firstly, thought is the fundamental reason for the existence of language, secondly, that thought is not language in the 'word-sentence' sense of the term, thirdly that as well as concepts, an essential part of thinking is to be found in the manipulative relational elements between concepts, fourthly, that these relational factors have reality in space-time changes, fifthly, that they can exist as internalised dynamic (or passive-observational) models which can be manipulated hypothetically. But most important of all these relational elements themselves can be symbolized (or represented) on the verbal word level, and

moreover these verbal equivalents of space/time relationships only become truly meaningful when they interconnect concepts. Thus, for example (a) I can actually look at a bush between two trees, (b) I can pictorially imagine a bush between two trees, and (c) I can say or write, "A bush between two trees." If we add the movement-change relation to the mix, usually in the form of a verb, (d) I can say, "A bush is standing between two trees." The complete relationship of bush and trees is (1) in the present time (2) standing (paradoxically a static motion) and (3) between, i.e. spatially in the 'center'. Similar analyses can be made for auditory, kinesthetic/motor, tactile, visceral images or any other kinds of imagery including mixtures of these. Even abstraction in this context, is a psychological image-concept phenomenon, essentially non-verbal in nature, which may sometimes be represented verbally.

Unfortunatley there is no space in this paper to elaborate further these aspects of thinking or the parallel symbolization process, language. Much of the above section has stressed the association of image/concept with language symbols particularly the auditory symbolic system. There is a need to clarify further the association processes between image/concepts, their auditory symbolic system and the visual symbolic system.

MEANING TO SOUND-LABEL ASSOCIATION

One point needs to be made clearly. Syntax or the sequence of auditory symbol-labels is almost completely determined by the

interrelationship determinants linking purely non-verbal image/concepts. Image/concepts as internalized 'things' are action-manipulated in space-time, selectively qualified with intrinsic attributes and quantified by relative evaluations, and it is the sequence of these factors which determines syntax.

e.g.	The heavy	man	ate	the brown	bread
	quantity	thing	action	quality	thing

If one asks why the sequence subject-verb-object (or its linguistic equivalent) occurs, the only answers are first, that this is the visual temporal sequence of the event in terms of their cause-and-effect importance to the speaker. e.g. "The heavy man caused to be consumed the brown bread." The continuing conversation is probably centered around the heavy man and his diet. The first 'thing' mentioned is usually the most important from the 'stage-setting' point of view. e.g. in the sentence, "The brown bread was eaten by the heavy man", the speaker no doubt feels the bread was most important and the continuing conversation is probably centered around the bread. It is worth noting that habitual thought sequences develop cliché-like habitual word sequences e.g. "What is for dinner tonight dear?" These can be automatically processed at speed. However original or strange thoughts (or when listening, words) may be very hesitantly processed. (Goldman Eisler 1964). The above discussion has elaborated the relationship of syntactical sequencing to meaning sequences. The image/concept to

sound-label association has been described earlier in the paper. There remains the auditory to visual symbol system association to clarify.

AUDITORY LABEL-VISUAL LABEL ASSOCIATIONS

Teaching children to read has led me to the conclusion that they learn to associate sound-labels with visual labels (and vice versa) on <u>both</u> a gestalt whole-word basis and on a phoneme-grapheme analytic-synthetic basis. Of course there will be a bias in keeping with the method used to teach the child to read but children taught to look-and-say will eventually develop a somewhat crude phoneme analysis and blending attack to use on new or difficult words. Although children taught through phonics analyse most words, there are some words with distinctive visual patterns which they seem to recognize immediately as a gestalt. Most research tends to indicate that a combined method with a slight emphasis on phonics is the most efficient technique for teaching reading. The three-quarters of school entry children who are verbally competent will rapidly learn to read by any method and often in spite of the teacher! Seriously though I often wonder if all the intense discussions on global reading methods are worth the, at best, marginal differences claimed for them.

However the least competent quarter of beginner readers, together with the severe reading disability cases are quite a different educational proposition. Slight differences in

teaching techniques or sensory training may bring about startling differences in attainment. The matching of specific remedial methods to specific deficits has beendealt with in another paper (Bannatyne, 1967) and I will not repeat myself here. Instead, I will briefly outline the associative processes involved in decoding (reading) or encoding (spelling and writing) from the auditory-visual point of view, i.e. taking the 'meaning' for granted. The child has to turn the gestalt of letters into sounds, or the gestalt of sound into letters. Most of us as competent adult readers can do this instantly either way but the beginner or poor reader who cannot recognize or spell a particular word has to cope with it with an analytic attack of some kind. Content may provide some clues but often there is insufficient evidence for even a reasonable guess.

IRREGULAR ORTHOGRAPHY

The phoneme-grapheme matching (orthography) system in English is notoriously irregular in both decoding and encoding. (Here decoding referes to decoding the visual graphemes into auditory phonemes, and encoding to 'translating' the auditory phonemes into visual graphemes. The fact that there are <u>two stages</u> or sets of both decoding and encoding in reading and spelling is never mentioned or made clear by most writers.) Because grapheme-phoneme orthography is so irregular, each paired association as it appears in each word has to be learned by

rote memory in association with the only distinctive feature of that word namely its meaning.in.context. The dog is a bow-wow; the knights bow to the Queen; the archer aims his bow; the bough is on the tree. The girl ties her hair with a bow because her beau is coming to meet her.

The phoneme-grapheme rote memory association (within a single 'content-meaning') is extremely difficult to establish in most severe reading disability cases. Even more difficult to ingrain is the rapid automatic sequencing of these associations, which after all is what reading or spelling is. In investigating this disability I have come to the conclusion that themajor problem for most of these children lies in their poor ability to identify auditory-phonemes and in the sequencing (blending) aspects of the phoneme-grapheme association. (There are quite a few children with disturbances of the visual areas of the brain but Frostig (1963) and others have thoroughly investigated them and their difficulties are not pertinent here.)

AUDITORY DISCRIMINATION OF PHONEMES

Usually children do not need to hear the separate phonemes within a word when they hear or speak them in normal conversation. No doubt to some extent the economies of the neurological computer do demand 'bit' storage of sounds possibly in two separate places, one for listening and one for speaking. This process is largely automatic and the sequences of 'bits'

become to all intents and purposes gestalts of sound which are near enough to their ideal phonetic equivalent. Because many reading disability boys do not listen accurately, their registration and production of words may be somewhat distorted, (slurred, phonetically inaccurate, etc.). In the course of normal conversation the auditory closure of <u>other</u> people (closure copes with accent variations, etc.) who are listening makes appropriate allowances for these mispronunciations so they do not matter. However in reading and spelling they can be a distinct handicap because the distortion of phonemes creates even more chaos and irregularity with grapheme processing. When spelling we internally sequence the phonemes and transpose them into graphemes. If (a) the phonemes are distorted, (b) phoneme-grapheme correspondence is inherently irregular and (c) the phonemes are auditorially unseparated in an 'outburst' of sound, then the grapheme (and hence letter) sequencing output on paper will be equally chaotic. Likewise in reading even if the poor reader with these three handicaps was able to split up words into purely visual grapheme segments, the decoding of them into their respective sequence of correct phonemes (which would then be blended into gestalts of sound) would be equally chaotic. This in fact is just what does seem to happen even though on test there is nothing wrong with the hearing or brains of these children.

Therefore, I advocate that in those reading disability cases whose vision and motor integration processes are neur-

ologically intact one should embark on an intensive training program which emphasizes listening to words and identifying phonemes, clear phoneme articulation as in elocution, the correct blending of phonemes in speech, the permutations and combinations of phoneme-grapheme memory associations learnt by rote (encoding and decoding), increased auditory closure from the child's own mispronunciations of 'sounded' words, and the identification of ambiguous graphemes/phonemes from the context of the sentence. Furthermore, if these children are taught to spell and write words and then sentences, they will automatically learn to read because the encoding process involves the recall of phoneme-grapheme equivalents 'out of the blue' without the aid of the visually recognized stimulus of the printed word. However any visual devices such as small letter cards or grapheme cards which facilitate correct sequencing are very much in order.

CONCLUDING REMARKS

This paper has surveyed the field of language learning in some of its aspects only very sketchily and much supporting argument and evidence has had to be deleted. If a slender case has been made for the importance of auditory factors in reading it will have served its purpose. Illiteracy is largely the result of legally requiring all children to reach a high level of attainment. If this was done for music many of us

might be found 'musically dyslexic'. After all, until recently almost all language was expressed vocally.

REFERENCES

Bannatyne, A. D. (1966) "Verbal and Spatial Abilities, and Reading." Paper read at the I.R.A. Congress, Paris, France, June. (Published Proceedings, I.R.A.)

Bannatyne, A. D. (1967) 'Matching Remedial Methods to Specific Deficits." Paper read at the International Convocation on Children with Learning Disabilities, Pittsburgh, February. The Home for Crippled Children. (To be published.)

Frostig, Marianne. (1963) "Visual Perception of the Brain-injured Child." American Journal of Orthopsychiatry. Vol. 33/34, 665-671.

Goldman, Eisler F. (1964) Paper printed in 'New Directions in the Study of Language" by E. H. Lenneberg (Editor). The M.I.T. Press, Cambridge, Mass.

Kirk, S. A. (1966) "The Diagnosis and Remediation of Psycholinguistic Disabilities." Institute for Research on Exceptional Children, University of Illinois.

Mountcastle, V. B. (Editor) (1962) "Interhemespheric Relations and Cerebral Dominance," The Johns Hopkins Press, Baltimore.

Osgood, C.E. (1963) "On Understanding and Creating Sentences." American Psychologist: Journal of the A.P.A. Vol. 18, No.12, December.

Penfield, W. and Roberts, L. (1959) "Speech and Brain Mechanisms," Princeton University Press, Princeton, N.J.

Wepman, J. M. et al. (1960) "Studies in Aphasia: Background and Theoretical Formulations." J. Speech and Hearing Dis. Vol. 25, 323-332.